The SEY Test Stand

Bob Zwaska

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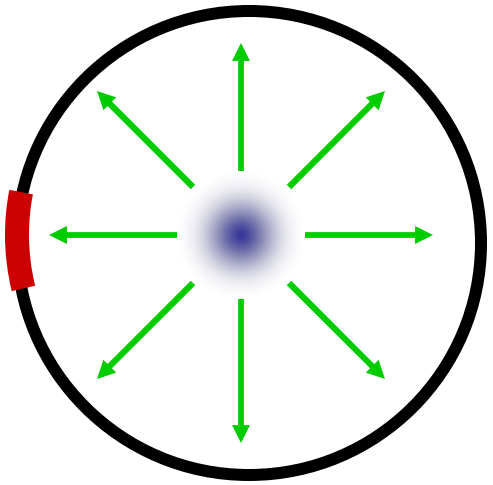
Electron Cloud Working Group Meeting

Introduction

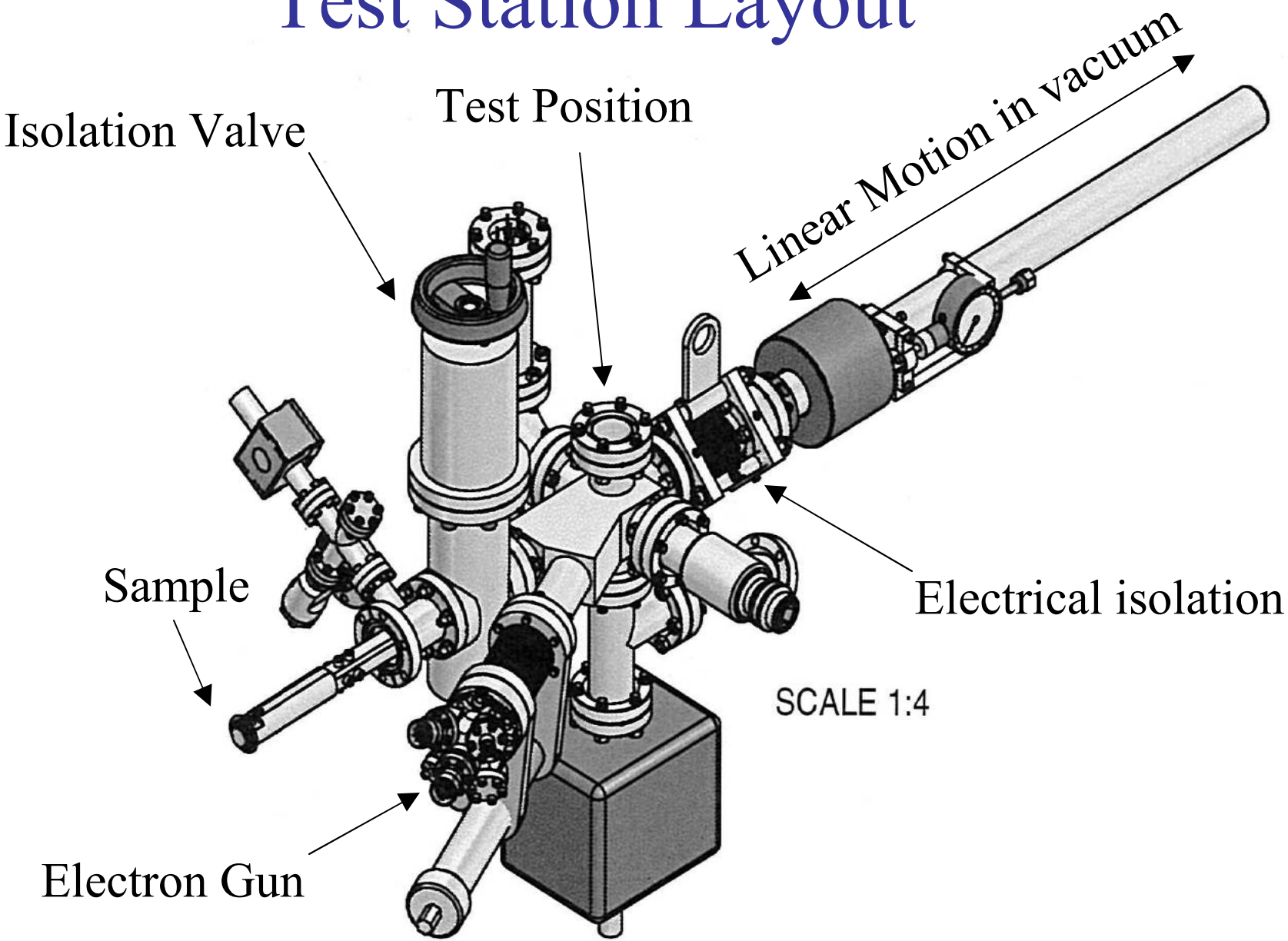
- As part of the CesrTA collaboration we have been building a test station for measuring the conditioned SEYs of irradiated surfaces
  - The basis for this station is the ECLOUD1 system that had been built and operated at SLAC
- Implementing this station in the Main Injector will help fill in the gaps towards deciding on a solution for Project X
  - The SEY information from the RFAs is only indirect – simulations have not yet given us a good correlation between ECloud threshold and SEY
  - The station will allow us to directly measure SEY of the materials to understand how far they have conditioned

Test Concept

- Place sample “buttons” of materials as portion of beampipe circumference
  - Beampipe made of standard materials – for us: Stainless 416L
- Directly measure the SEY of the sample
  - SLAC did this by removing the button and testing in a surface physics lab
  - At Cornell, it has been modified for *in situ* measurement
- Other considerations:
  - Change pieces without breaking vacuum
  - Monitor electron flux
  - Differential scrubbing can be factored out



Test Station Layout

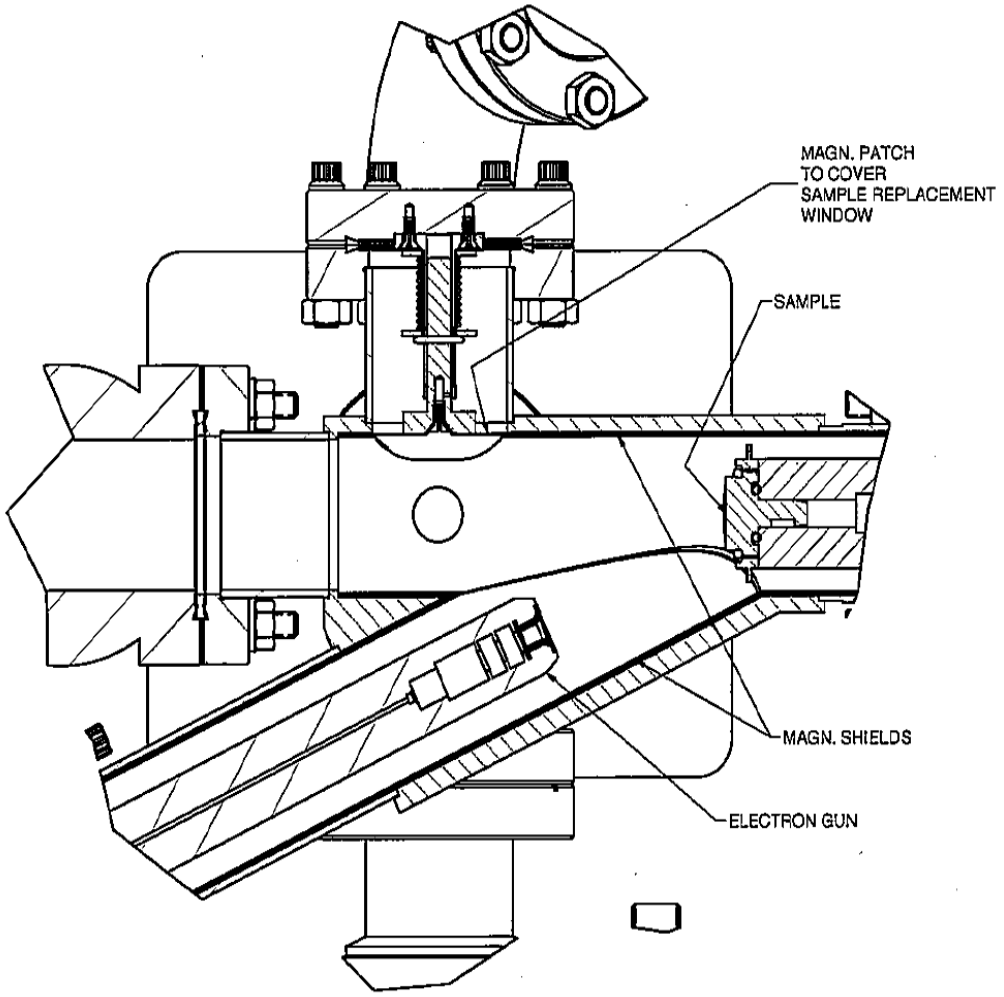


Measurement Sequence

- Samples will be measured in the station as installed
  - Pumped down
  - Initial SEY measurements made
- Samples pushed against beampipe
- Samples irradiated until access opportunity
  - Electron flux monitored with nearby RFA
- Make SEY measurements
  - Use a cart with power supply, picoammeter, and computer
  - Measurements take ~ 30 minutes each
  - Expect ~ 2 hours for the whole procedure

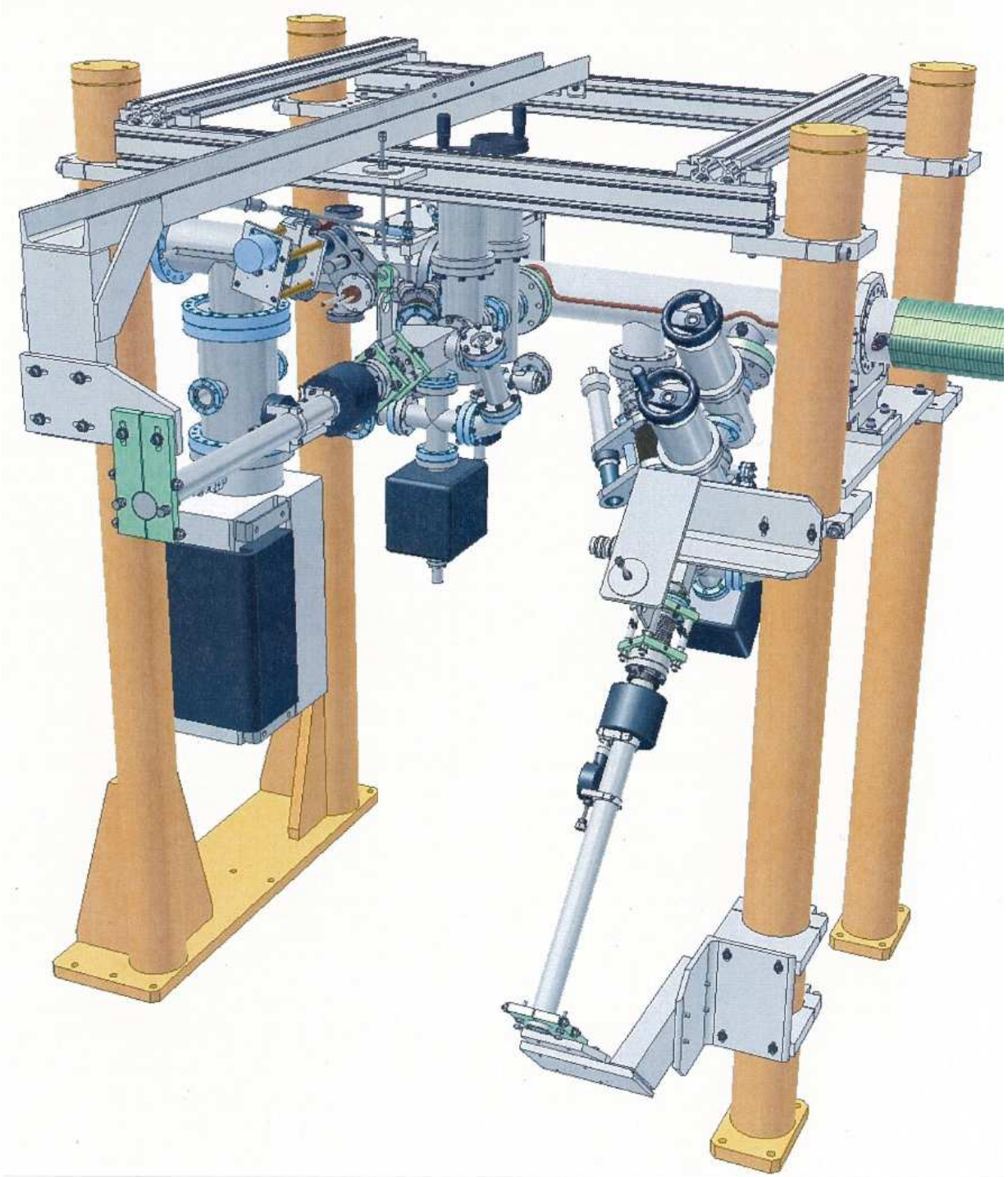
SEY Measurement

- Sample is withdrawn from beampipe
- Sample holder is electrically isolated from ground
  - Attached to picoammeter
  - Biased at -20 V to repel secondaries
- Gun is permanently installed in setup
- Power supply brought in for measurements
- LabView controls the gun through the SEY scan
  - Can include rastering across surface
  - Picoammeter read out simultaneously
- Scan should take ~ 30 minutes
  - Still being optimized, could be longer or shorter
  - Need to understand gun cathode heating time



Planned Cornell Installation

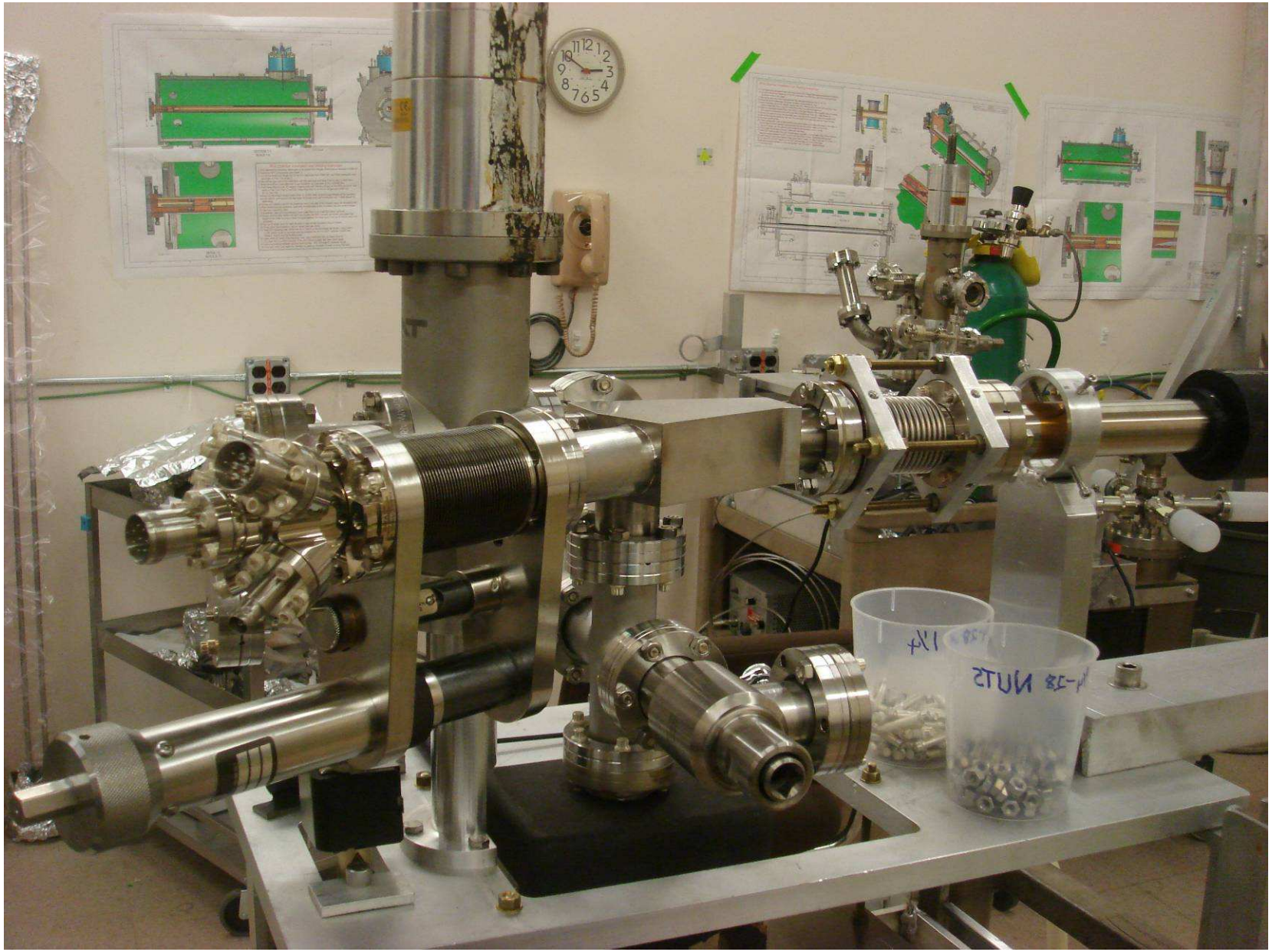
- Install on CESR ring short straight
- Horizontal to catch synchrotron strip
- 45º to be off-stripe



Test Station Status

- Cornell has prototype station
  - Undergoing bench tests
  - Hope to install with the next month
- Final stations will be built in the next few months
  - Including two for us
  - Cornell will also build a suitable spool piece for us, if they have the necessary specifications
- Data acquisition is done with LabView on a PC
  - Using electron gun power supply and picoammeter
  - Plan is to have SEY scans take ~ 30 minutes

Prototype Pictures



Prototype Pictures

Planning for Main Injector Installation

- Location: 521 experimental area?
  - Install next to or nearby the test chambers
  - Spool piece will be 6” round – needs to be to MI specifications
  - Best chance for installation: summer 2010
- Install both vertically to avoid aisle and wall
  - Should have some clearance to Recycler
  - Need to design and build support structure
- Add another RFA for electron counting
- Need to get identical equipment to Cornell
  - Custom gun power supply
  - Picoammeter(s)
  - LabView setup
    - Cornell has the vi built, but we need to be able to use it

Summary

- Directly measuring the SEY of conditioned materials will give us confidence for Project X plans
  - Also, stainless pipe will allow conditioning TiN samples further than an all TiN pipe
- The test station for this purpose is being built at Cornell from an initial SLAC design
  - We may have the opportunity for simultaneous tests of materials
- Intend to install two stations in the Main Injector in 2010
  - Get beam pipe specifications to Cornell
  - Design and build support structure
  - Replicate Cornell DAQ system (and be well versed in it)